Past and Current NLM Programs

The Library traces its origin to the U.S. Army Surgeon General's office which in 1836 budgeted $150 for "medical books" for officers. That seed money could not have fallen on more fertile ground. From that simple beginning has evolved the world's largest and most dynamic collection of health science literature — the National Library of Medicine.[1]

The single most important figure in the Library's history did not come on the scene until 1865, when Civil War surgeon John Shaw Billings took charge of the collection. He directed its fortunes for the next 30 years, guiding it to a position of preeminence among medical libraries that the institution has held ever since. The *Index Medicus*, begun by Billings in 1879, is still published by the Library and used by medical professionals around the globe.[2]

If the Library's Golden Age was the Billings era, its Renaissance began in 1965 with the introduction of MEDLARS (Medical Literature Analysis and Retrieval System) and continues today.[3] One event that stands out in the 70 years between Billings and MEDLARS is the 1956 legislation (Public Law 84-941) that gave the Library its current name and placed it under the U.S. Public Health Service. Setting a broad mandate to improve the nation's health through improved information services, the legislation also created a Board of Regents to guide the Library in matters of policy.

1965: The Beginning of the Library's Modern Age

Notwithstanding that landmark 1956 legislation, the year 1965 may for several reasons be designated as the revitalization of the National Library of Medicine.

First, it marked the beginning of the computerized MEDLARS system, which grew out of the Library's manual indexing of journal articles. Its inauguration allowed publication of the references in *Index Medicus* to be undertaken at a speed previously unimaginable.[4] Other bibliographies, catalogs, and indexes soon followed, all made possible by MEDLARS and the pioneering computer-driven phototypesetter called GRACE (Graphic Arts Composing Equipment) developed for the Library at the same time.

The importance of this event and the effect it was to have, and continues to have, on the American medical community cannot be overestimated. MEDLARS marked NLM's first major foray into the world of computer technology. And its success gave the Library the confidence it needed to continue developing innovative information services for the health sciences.

Second, 1965 saw the passage of the MLA Act (Medical Library Assistance Act,) which reflected the strengths and weaknesses of the biomedical information environment in 1965: On the strength side, there existed a health science library community with a strong spirit of cooperation. Added to that was NLM, which provided a nexus of leadership. On the other side, the weak status of individual health science libraries was well documented. It was common knowledge that increasing demands for information services, corresponding to the large growth in research and education, could not be met by existing library resources.[5] A critical imbalance existed. The MLA Act provided the

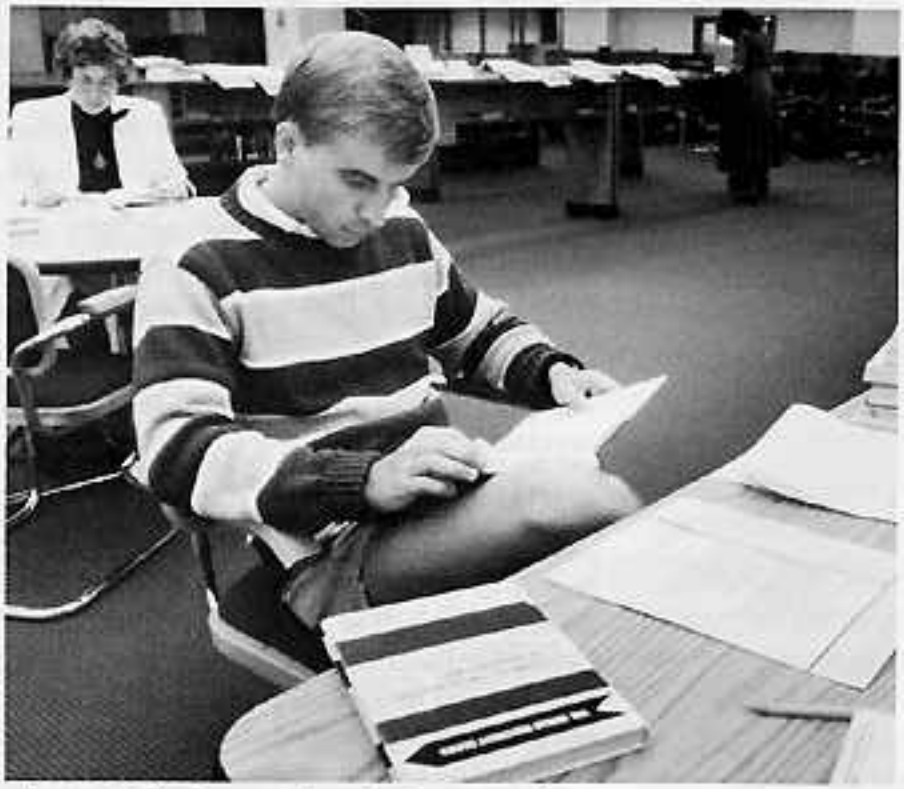
means to unite librarians and libraries, health professionals and institutions, and NLM in achieving the common goal of improving health information access.[6]

Progress under the Act has been significant, and the Congress has renewed the legislation repeatedly. By 1986, some $150 million had been awarded to more than 1,000 institutions for the development of library resources, services, and networks; the education and training of specialists to manage and deliver biomedical information, including medical librarians and medical informatics researchers; the preparation and publication of important scientific publications that are not commercially viable; and the conduct of research in library and information science and medical informatics.

Perhaps the most lasting contribution of the Medical Library Assistance Act, however, was to mandate the creation of a national biomedical information infrastructure in the form of a RML (Regional Medical Library) Network. To that end, the Act actually authorized NLM to construct "branch" libraries, but the authorization was never put to use.

Instead, it was decided to form a hierarchical network with four levels of institutions. At the base of the network are the hospital and other local libraries used by health professionals in their day-to-day practice. These libraries turn for help to "resource libraries" — primarily those at medical schools. The next level comprises seven Regional Medical Libraries, each responsible for a geographic portion of the United States. Finally, there is the National Library of Medicine itself, serving as a resource for materials not available elsewhere in the Network.

Each year, some 2 million copies of journal articles, books, and other library materials are lent expeditiously among the libraries in the Network. Requests frequently are routed



electronically from one institution to another. The result is that American health professionals, no matter where they are located geographically, have rapid and comprehensive access to the literature of biomedicine.[7,8]

New Responsibilities

The publication in 1962 of Rachel Carson's *The Silent Spring*[9] was a powerful spur to the public and its elected representatives to take action to protect the environment. A report to the President in 1966 by his Science Advisory Committee found an urgent need for computer-based environmental and toxicological information to be made widely available to health professionals and scientists. As a result of recommendations in that report, the Department of Health, Education, and Welfare directed the National Library of Medicine to establish a Toxicology Information Program.[10]

Since its inception in 1967, the goals of the Toxicology Information Program have been quite straightforward: to create and maintain automated data banks of information on toxicological subjects and to disseminate that information widely. In its role as disseminator, the program originally emphasized publishing bibliographies and providing reference services. When online data base searching was instituted at NLM, however, the Toxicology Information Program was quick to take advantage of that capability.

That the Library was able to develop a successful online retrieval program was due largely to the efforts of the research and development staff of the Lister Hill National Center for Biomedical Communications. This research and development function was the second major new responsibility given to the Library. The Center, created in 1968 by the U.S. Congress, is named after Senator Lister Hill who, with Senator John Kennedy, sponsored the 1956 National Library of Medicine Act.

The Lister Hill Center pioneered in the application of space-age technology for experimental networks.[11] One of the first was the prototype of the NLM online retrieval system, MEDLINE. Others included radio and television communication via NASA satellite linking remote Alaskan villages with Public Health Service physicians,[12] a two-way microwave television network tying together outlying health facilities in New England, and a national network for accessing computer-based health education materials.[13]

At present, the Lister Hill Center is involved in a variety of projects that may be characterized as falling into three groups: those concerned with improving educational techniques in the health sciences (example: the TIME—Technological Innovations in Medical Education—project); those involving artificial intelligence or expert systems (example: AI/RHEUM—artificial intelligence in rheumatology); and those which will improve the storing, processing, and dissemination of library-based information (example: the EDSR—Electronic Document Storage and Retrieval—project).

The MEDLARS/MEDLINE Network

In the early 1970s, the Lister Hill Center successfully experimented with an online information retrieval project known as AIM-TWX. This combined a modest computerized data base of references (those appearing in the *Abridged Index Medicus)* with the communications network—TWX (Teletype-writer Exchange Network). The resulting experimental network was so successful that the Library offered an expanded nationwide service, MEDLINE, in October 1971. Today, the MEDLINE data base (and its backfiles to 1966) contain more than 5 million references, many with abstracts. It is an expanded, electronic *Index Medicus.*[14]

MEDLINE was soon joined by other online data bases — TOXLINE (toxicology information online), CATLINE (NLM catalog online), CHEMLINE (chemical information online), AVLINE (audiovisuals online), and so forth. Today, more than 20 online data bases are available to thousands of institutional and individual users in this country. In 1986, those users will do more than 3 million bibliographic searches on NLM's computers. In addition, several U.S. commercial networks lease NLM's data bases and make them available for online searching to their customers.

Internationally, MEDLINE is available via formal arrangements between the National Library of Medicine and major institutions in 16 nations. Some of those foreign centers have direct access to NLM's computers in Bethesda; others provide search services on their own computers from tapes of the data base provided by NLM; some do both. The foreign partners in turn provide search services to health professionals in neighboring countries. The result is that NLM's MEDLINE has a high reputation throughout the world's health community.

The newest addition to MEDLARS is a software program known as GRATEFUL MED. A floppy disk system designed for personal computers, it allows simple, direct access to MEDLINE by individual health professionals, as well as by librarians and information specialists. GRATEFUL MED will undoubtedly transform MEDLINE's traditional audience of institutional users to a mixture including substantial numbers of individual users.

The present decade has seen a number of new initiatives at NLM. Examples are IAIMS (the Integrated Academic Information Management Systems), UMLS (the Unified Medical Language System, and a special emphasis on preserving the NLM's collections. These initiatives are described in some detail in the Panel reports. In addition, NLM is encouraging experiments in dissemination of MEDLINE and other computer files via the new CD-ROM disk technology (compact disk-read only memory) through agreements with a number of domestic and foreign commercial information vendors.

Recognizing the importance of the recent discoveries in molecular biology, NLM has already initiated a number of experiments. These include an advanced scientific workstation that facilitates access by NIH research scientists to GenBank computer records of nucleic acid sequence data, MEDLINE bibliographical records in molecular biology, protein products sequence data, and online access to "Mendelian Inheritance in Man," the genetics text.

Further experiments include efforts to link NLM users via electronic gateway functions to these and other information networks.